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A new flotation cell with separating propeller and centrifugal air inl ets

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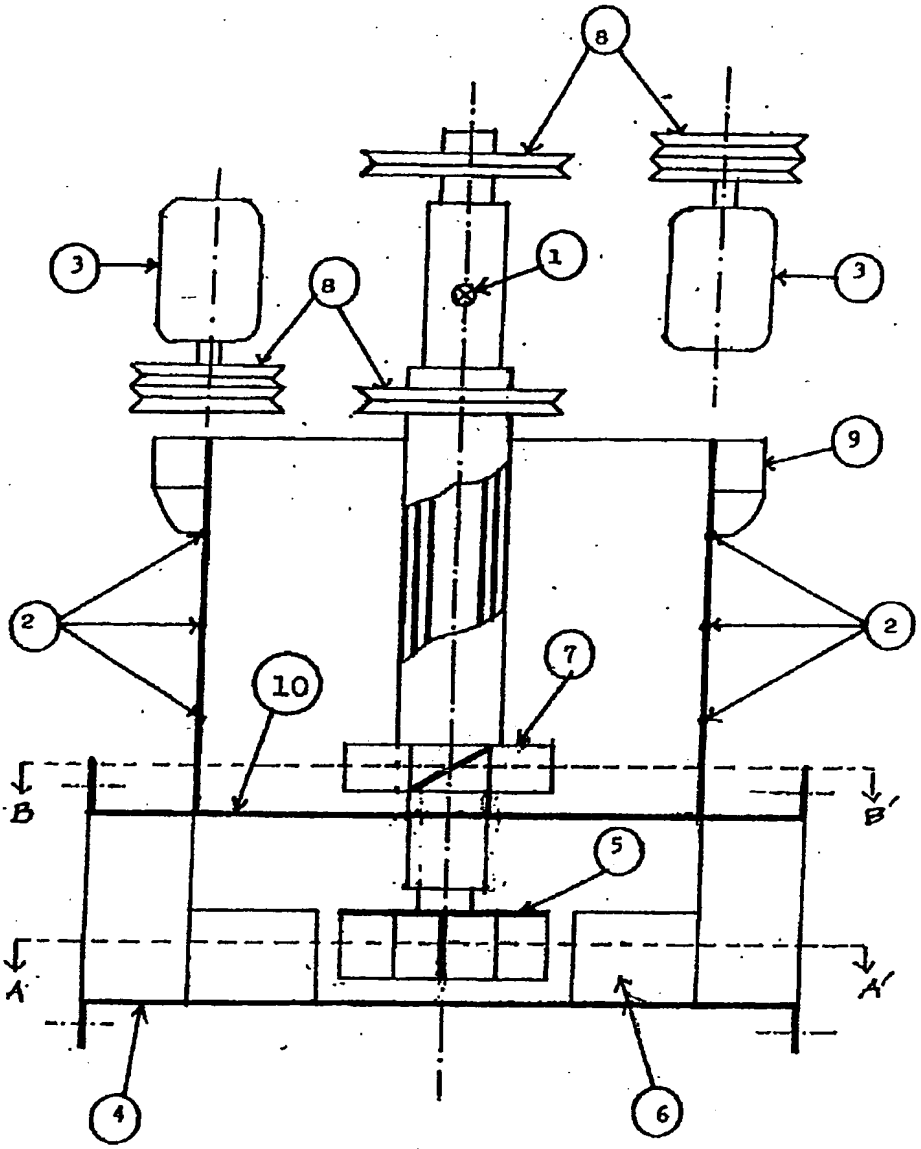
ABSTRACT

The functions of a new flotation cell with additional separating impeller(7) to the conventional stirring impeller(5) are fully described. The cylindrical shape of the cell is chosen in order to create centrifugal forces within the cell for the effective separation of the mineral laden air bubbles from unaffected mineral grains. Additional excess air is introduced by tangential air inlets(2) into the cell to increase centrifugal forces.

FIGURE 1



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COMPLETE SPECIFICATION
STANDARD PATENT

A NEW FLOTATION CELL WITH SEPARATING PROPELLER AND CENTRIFUGAL AIR INLETS.

The following statement is a full description of this invention, including the best method of performing it known to me.

BRIEF DESCRIPTION OF FLOTATION PROCESS

Flotation or froth flotation is a physico-chemical method of concentrating finely ground ores. First condition is to liberate mineral grains within ore matrix. This function is achieved by grinding. Separations of liberated mineral grains are realised by several physical concentration methods. One of the most effective method of separation process flotation particularly for fine mineral grains.

This process involves surface treatment of mineral grains by some chemicals (collectors and modifiers) in a pulp to create conditions for the attachment of desired mineral grains to air bubbles. Unaffected, undesired mineral grains are left within the pulp. The air bubbles or so-called froth carry selected mineral grains to the surface of the pulp and these mineral grains are collected in froth product while other mineral grains remain in the pulp. Afterwards the process can be repeated by modifications of the pulp conditions namely by adding new chemicals (collectors and modifiers). The other valuable minerals can be recovered as second or third froth products and so on.

Flotation process is carried out in flotation machines or cells. The main function of flotation machines can be defined as follows:

1. To keep mineral grains in suspension within a pulp. This very important function is carried out by an impeller in a flotation cell. An impeller revolves at certain speed (about 500-2000 rev./Min.) in a pulp.

2. To create small bubbles within the pulp. These air bubbles are introduced into pulp by suction of an impeller in sub-aeration flotation cells and by pressurised air in pneumatic flotation cells. Flotation cells are also equipped by air breakers to divide the introduced air into small bubbles. Furthermore the air bubbles are gained consistency and certain strength by addition of so called chemicals (frothers) to the pulp.

3. To maintain the collision between air bubbles and mineral grains for attachments. This function is also carried out by the impeller in flotation cell. In fact the impeller has dual function of keeping mineral grains in suspension and providing collisions between mineral grains and air bubbles.

4. To separate mineral grains laden air bubbles from non-attached mineral grains. This function is carried out in conventional flotation cells simply by earth gravity. Mineral grains laden air bubbles are raised to the surface of the pulp by the buoyancy of the water or better of the pulp, while non-attached mineral grains are left in suspension within the pulp.

5. To remove mineral grains laden air bubbles or so called froth product from flotation cell. This function is carried out either by free flow of the froth or skimming off action of rotating paddles.

BRIEF DESCRIPTION OF DRAWINGS

A better understanding of the present invention will be had upon reference to the following detailed description when read in conjunction with the accompanying drawing, wherein like reference characters refer to like parts throughout the several views and sections and in which:

Fig.1 is the main view of the flotation cell of present invention where:

1. Main Air Inlet
2. Auxiliary Centrifugal Air Inlets
3. Electric Motors
4. Feed Inlet and Outlet
5. Stirring Impeller
6. Air Bubble Breakers
7. Separating Propeller
8. V Belt Drives
9. Froth Collecting Trough
10. Separating Grates

Fig.2 is the top view of the flotation cell where:

1. Main Air Inlet 2. Auxiliary Centrifugal Air Inlets 3. Electric Motors
8. V Belt Drives 9. Froth Collecting Trough

Fig.3 is A-A' section of the flotation cell where:

5. Stirring impeller
6. Air Bubble Breakers

Fig.4. is B-B' section of the flotation cell where:

7. Separating Propeller
10. Separating grates

BACKGROUND OF THE INVENTION

So far all industrial flotation cells are equipped with only single stirring impeller and one central air inlet. This new invented cell differs from conventional cells having additional separating propeller and centrifugal air inlets.

Main view of new invention is shown in Fig.I. Main body of the cell is a cylinder. Air is introduced to the cell by main central air inlet (1) by the suction of the impeller (5) or by pressurised air. Furthermore additional air is introduced tangentially through auxiliary centrifugal air inlets (2) by pressurised air. The number of these auxiliary air inlets may be regulated according to the depth of the cell. In the above Fig.1 six of those are seen.

Stirring impeller (5) and separating propeller (7) are driven particularly at different speeds by separate motors (3) through V Belt Drives (8).

The pulp of consisting of suspended mineral grains in water is introduced into flotation cell by an elliptical pipe feed inlet (4) and after the separation of selected mineral grains via froth into froth collecting through (10) by free flow the remaining mineral grains in the pulp are taken out by the same elliptical pipe outlet (4).

In Fig.2. top view of the flotation cell with main air inlet (1), auxiliary centrifugal air inlets (2), electric motors (3) and V belt drives (8) are shown. Here also top view of froth collecting trough (9) is seen very clearly. Froth will be flowing freely into trough.

In Fig.3. A-A' section of the flotation cell with stirring impeller (5) and air bubble breakers (6) sections is given. As in all conventional flotation cells the functions of the impeller are to mix the particles to get suspensions or so called pulp and to provide collisions between mineral grains and air bubbles. The function of the air breakers is to divide the air into small air bubbles.

In Fig.4. B-B' section of the flotation cell is shown. Effective separation of the mineral laden air bubbles from non-attached mineral grains is realised by centrifugal forces created by separating propeller (7) within the pulp. In conventional cells this function of separation is realised only by buoyancy of the pulp. Mineral grains laden air bubbles or so called froth is raised to the surface by buoyancy while non-attached mineral grains are kept in suspension within the pulp. In addition centrifugally introduced air bubbles through auxiliary air inlets (2) will also create centrifugal movements to the mineral grains and air bubbles within the pulp.

The function of the grates (10) is to separate the mixing chamber of impeller (5) and separation chamber of separating propeller (7) from each other. Number of grates will be variable according to the requirements. In Fig.4. 16 of those are seen.

In above figures only one flotation cell is shown. In actual industrial operations many number of these cells will be necessary due to large

tonnage of the ore and different type of flotation steps such as roughing, scavenging and cleaning etc. Therefore many number of flotation cells are attached to each other in series as required.

5 Having those described my invention, however many modifications there to will become apparent to those skilled in the art to which it pertains without deviation from the spirit of the invention as defined by the scope of appended claims.

The claims defining the invention are as follows:

1. Separating Propeller (7)

As described in previous text the function of the separating propeller is to create centrifugal forces within the pulp in addition to the buoyancy of the pulp in the separation of mineral grains from non-attached mineral grains, so that the separation will be much effective and in much shorter time.

The speed of the separating propeller will be adjustable to suit most effective separation. In fact separating propeller (7) and stirring impeller (5) are driven by separate electric motors at different speeds so that most suitable speeds of both can be chosen.

2. Auxiliary Air Inlets (2)

These auxiliary centrifugal air inlets will create additional centrifugal movements within the pulp. These centrifugal movements will help also to the separation of mineral grains laden bubbles from non-attached mineral grains in the pulp.

3. Separating Grates (10)

The separating grates are separating the mixing chamber of impeller (5) and the separation chamber of separating propeller (7) from each other. The functions of these two chambers are different. In mixing chamber the collisions between mineral grains and air bubbles are of prime importance while in separating chamber the separation of mineral grain laden air bubbles and non-attached mineral grains is sought. Due to opposite functions of those, these chambers should be separated to certain degree. This separation is achieved by grates. Number of the grates will be variable according to flotation requirements.

4. Cylindrical Shape Of Flotation Cell.

In the creation of the centrifugal forces by separating propeller (7) and tangential auxiliary air inlets (2) the shape of the cell is of prime importance. In fact the shape of mixing chamber of the stirring impeller (5) is not important but the shape of the separation chamber of separating propeller (7) is very important and must be cylindrical for the formation of centrifugal movements.

APPLICANT: _____ DATE: 29.4.1999

FIGURE 1

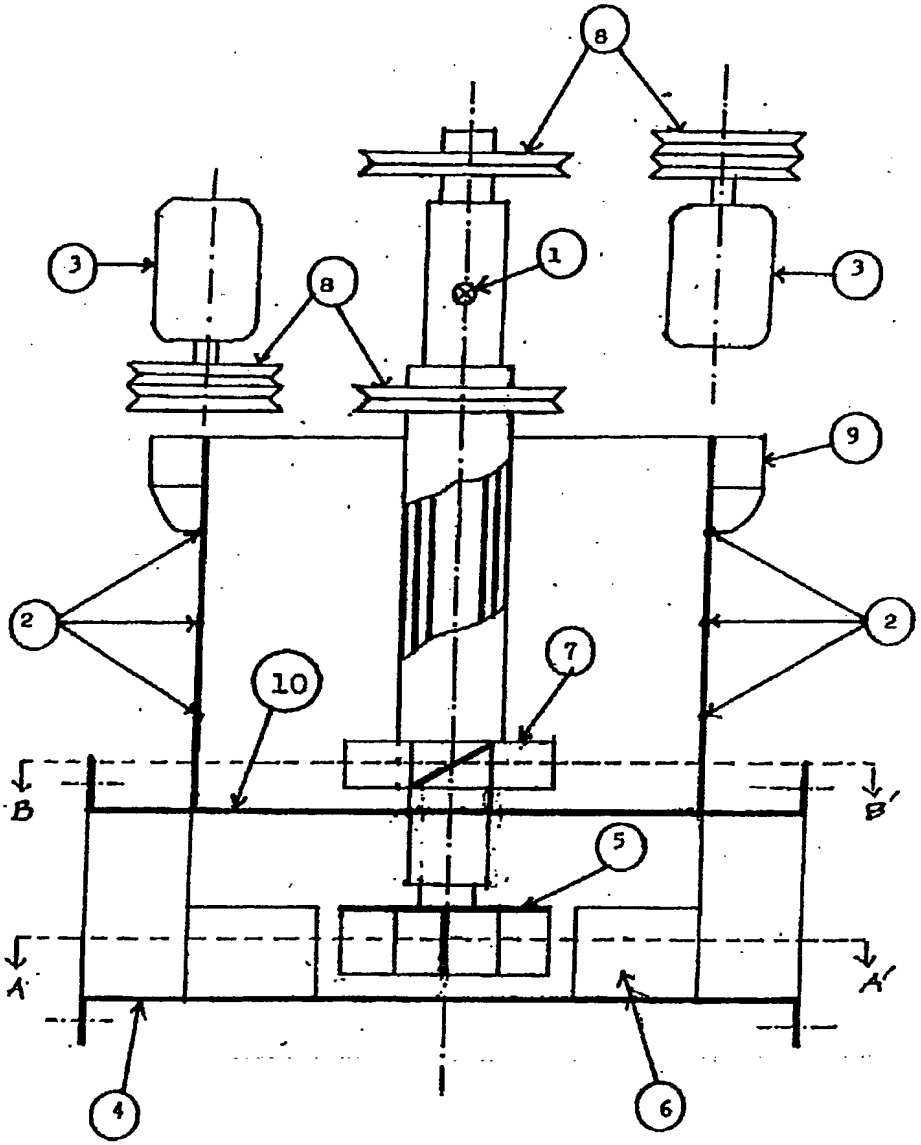

FIGURE 2

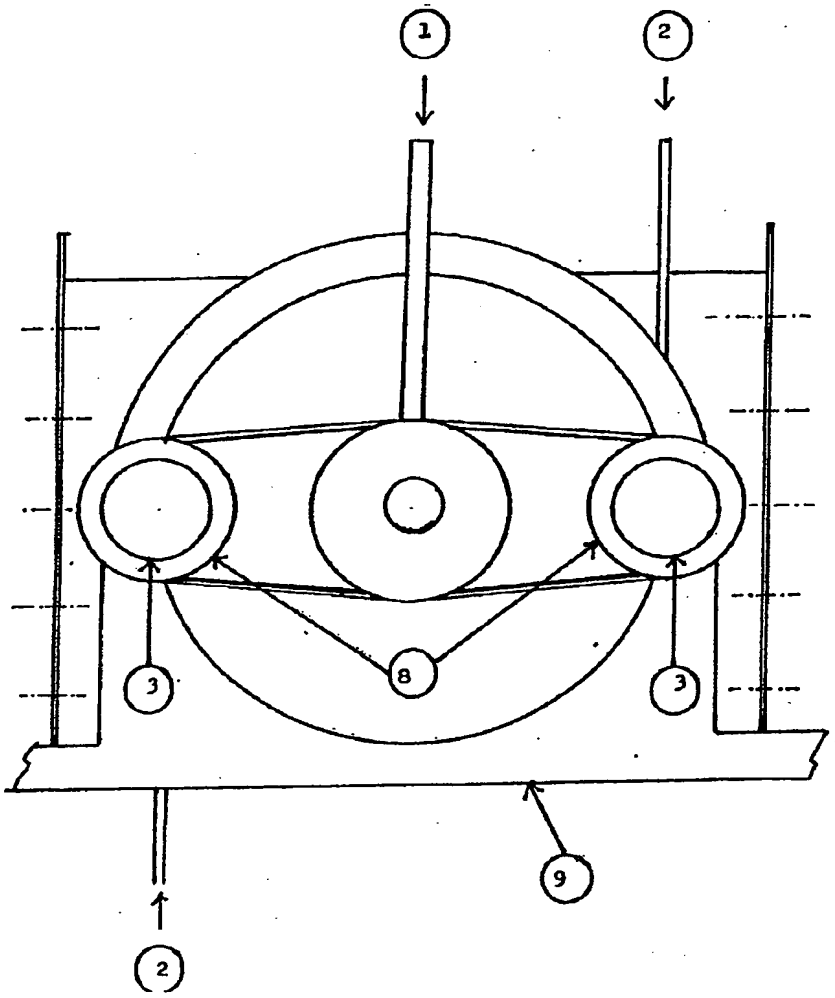

FIGURE 3

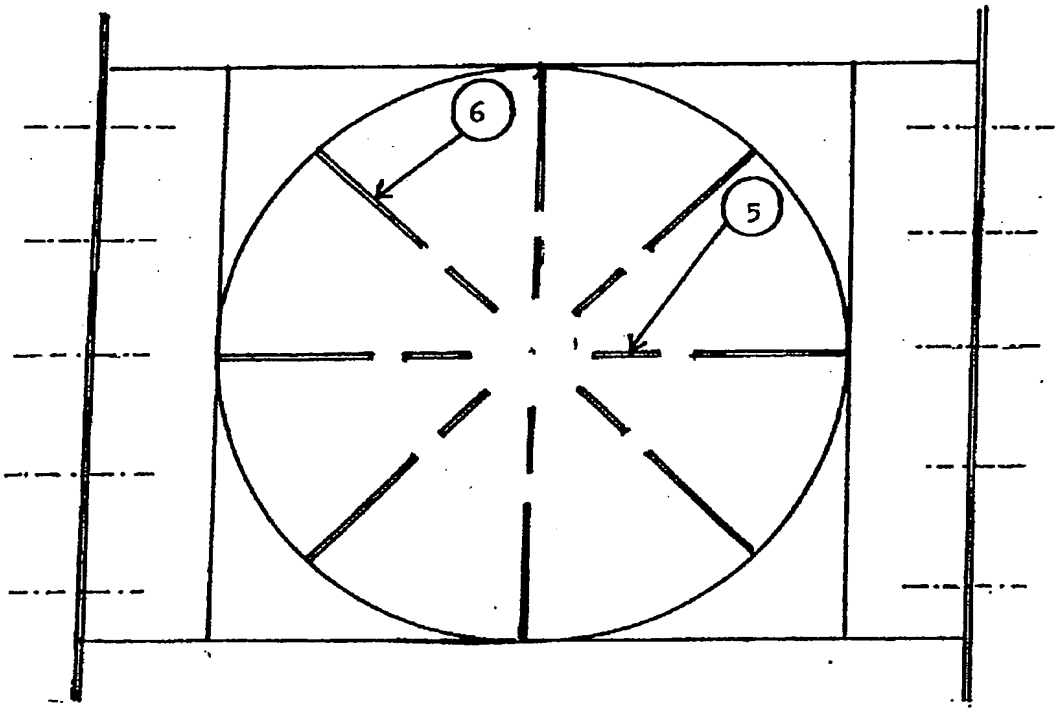

FIGURE 4